

early English *citra*, *cetera*, or more modern *cittern*. "Fu la cetera usata prima tra gli Inglesi," says Galilei. Examples of instruments of this kind are frequent, but M. Engel startles us by exhibiting the following as an original "*German Fiddle*, IXth century, St. Blasius."

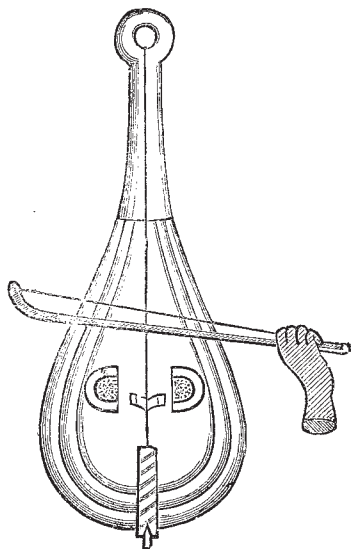


FIG. 7.—Fiddle String. XIIIth Century. (St. Blaise.)

The above is copied from Gerbert's "*De Cantu et Musica Ecclesiae*," vol. ii., and is derived from a manuscript which was formerly in the monastery of St. Blaise, and which Gerbert describes as "about 500 years old!" (ex cod. San. Blas. annorum. circ. 500, p. 139) as he wrote in 1774. That would bring the date to the second half of the *thirteenth* century, instead of the eighth or ninth, as M. Engel states in his text. Moreover the plate is not intended to exhibit a fiddle, but a fiddle-string. It is called *lyra*, and the word is explained in two of the glossaries collected by Mr. T. Wright. A fiddle would have had more strings than one, in the thirteenth century, and the strings would have been fastened to pegs instead of a single string passed through a ring.

It will be seen from the above that the claims for Germany are put forth in the strongest light by M. Engel, and that other countries may not so readily acquiesce in them. We ourselves should raise many demurrers to his claims and conclusions, but they would apply to the prefatory essay and to the musical instruments of Europe, rather than to those of the rest of the world. While we cannot but wish that M. Engel's nationality had been less strongly developed, he is justly entitled to the credit of having ably fulfilled his commission, and of having exerted extensive research.

OUR BOOK SHELF

Notes on the Practical Chemistry of the Non-Metallic Elements and their Compounds. By William Procter, M.D., F.C.S., Lecturer on Chemistry at St. Peter's School, York. (London: Simpkin, Marshall, and Co. York: the Northern Educational Trading Co.)

THIS is a handbook on the Practical Chemistry of the Non-metallic Elements, designed to meet the requirements of pupils of Mechanics' Institutions, and of Science

Classes of a similar kind. The true man of science welcomes every worthy means of spreading scientific truth, and does everything in his power to propagate that truth. He will regard with a jealous eye each work brought forward with a view of extending a knowledge of the sciences; and with a work intended for the use of a class whose opportunities of gaining knowledge are very limited, his scrutiny will be all the closer. A book written for the information of such should be couched in the simplest language, and the sense conveyed should be at once clear and comprehensive. In these respects Dr. Procter's little work cannot be termed a success. To use no stronger expression his language is frequently very vague. For example, on page 14 the author in speaking of "*Chemical Affinity*" says: "hence, in order that this force may be exercised by the particles coming within the sphere of each others' attraction, the substances must be in the state of liquid or gas." There can be but one way of understanding the latter part of this quotation, viz., that no chemical action can take place, unless the materials taking part in that action are each and all of them in a liquid or gaseous state. Dr. Procter is scarcely less happy in his definitions of bases, acids, &c. He says: "An acid is a compound of an electro-negative radical with hydrogen, which hydrogen it can exchange for a metal or basylous radical, and it is therefore replacable." Again, "A salt is a compound produced by the action of a base upon an acid with the displacement of the hydrogen of the latter." How can such definitions convey to the minds of pupils proper ideas of the true natures of acids and bases? Such explanations would not inappropriately be termed *indefiniteness*. Chapters are devoted to chemical calculations, and chemical manipulations, and here doubtless the readers will find many useful hints for their guidance in the preparation of their apparatus, &c. In the body of the book Dr. Procter treats of the non-metallic elements, giving the ordinary methods of preparing them, and their compounds, and illustrating the characteristics of each by interesting and instructive experiments. A few pages devoted to the chemistry of water, qualitative analysis of gases, and the preparation of ordinary reagents, complete a book, which, designed for a good purpose, and containing much useful information, at the same time shows want of care in compilation, and also lacks lucidity. Printer's errors are much too numerous.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

The Use of the Words "Weight" and "Mass"

Nothing could illustrate more forcibly the necessity of rendering definite the meaning of some of our present fundamental terms in connection with the science of dynamics, than a comparison of my letter to you on this subject (vol. xiii. p. 325) with the letter of Mr. Stoney, in reply to it (vol. xiii. p. 385), and that of Mr. Walker who follows Mr. Stoney.

When we who call ourselves teachers do not agree as to the signification of the most elementary terms we use, it is not to be wondered at, if those who come to learn should fail to attain clear ideas on a part of the science, where such confusion of nomenclature prevails.

My letter to you was for the purpose of pointing out an ambiguity of language, and of suggesting, in order to get rid of this ambiguity, not an alteration of the meaning of any word whatever, but a very simple *restriction* in the use of words, and the bringing into more frequent employment a very valuable old word—*gravity*—which has been lying ready for use but left almost idle. Mr. Stoney admits the ambiguity to be a very real one.

Mr. Stoney, however, says: "I fear Mr. Bottomley's remedy,

if adopted, would introduce quite as serious, perhaps a more serious ambiguity. Gravity is an acceleration. When we say that gravity is less in a balloon, or in a mine, than at the surface of the earth, or greater at Glasgow than at Manchester, we are speaking of alterations of g —the acceleration due to the earth's attraction; and it would create confusion to employ this word to designate forces also."

Now I do not think that the use of the word gravity as an acceleration is at all common. On the contrary, I have looked into all the books at my command and I cannot find any support whatever for such a use of the word. Every one is accustomed to speak of the "force of gravity." To speak of the force of an acceleration would be a complete anomaly.

All the dictionaries that I have seen support my view that gravity means force, and does not mean acceleration. Take, for example, a good modern book, the Imperial Dictionary. There I find—Gravity (Lat. *gravitas* from *gravis*, heavy). 1. Weight, heaviness. 2. In philosophy—that force by which bodies tend or are pressed, or drawn towards the centre of the earth—and so on; showing that gravity always means force, though it has various shades of meaning in its occasional applications.

Chambers' Encyclopedia says that the force which causes bodies to fall towards the earth is termed *gravity*. The article goes on to speak of the force of gravity at the earth, at various heights above the earth, and at the moon. Acceleration is nowhere mentioned as a meaning of the word gravity.

Even if it could be shown that a few people have so far departed from the original etymological sense and prevailing use of the word gravity, as to employ it for an acceleration instead of for a force, this would only prove that the word is, to that limited extent, subject to ambiguity at present. The course that I advocated was to avoid ambiguity by employing the word *gravity*, used in its most common, and most authoritative sense, instead of a thoroughly ambiguous word *weight*, in certain cases where misapprehension from the use of the latter word is likely to occur.

It seems to me that Mr. Stoney and Mr. Walker have been led away by thinking of the letter g , rather than of the important question at issue. The letter g stands for a number. One way of specifying what number g stands for, is to say that it is the numerical expression for the acceleration due to gravity, that is, the acceleration due to the force of gravity acting on a falling mass. But this is simply because g is the number which represents the force in Gaussian units on unit mass, and because the force of attraction on any body is proportional to the mass of the body. The latter is an experimentally discovered law. To say with Mr. Walker that "the symbol ' g ' is gravity," and with Mr. Stoney that "gravity is an acceleration," seem to me expressions equally elliptic on the one hand, and, without full explanation, misleading on the other.

If Mr. Stoney offers any method of getting rid of the ambiguity better than that already introduced, others will gladly adopt it. As to Mr. Walker's proposal to confine the use of the word "weight" to mean force, my former letter was partly for the purpose of showing this to be impossible. The act of parliament, regulating weights and measures, settles that matter. Mr. Stoney's letter forms, also, a sufficient answer to Mr. Walker's proposal.

University, Glasgow, March 27

J. T. BOTTOMLEY

P.S.—Allow me to thank Mr. Barrett for his information as to the earliest use of spring balances for kilodynes.

If Mr. Walker is serious in proposing to use *vires* for British kinetic units of force, he ought to avoid *centivires* and *millivires* for 100 vires and 1,000 vires respectively. These would be utterly incompatible with the use of the prefixes *centi*, *hekto* and *milli*, *kilo* in the now established metrical system.

Birds as Astronomical Objects

THE following note which appears in the last number of *Stray Feathers* (iii. p. 419), seems to deserve more attention from astronomers than it will perhaps receive unless published where it will meet the eyes of others than Indian ornithologists. I beg leave, therefore, to ask that it may be reproduced in NATURE.

"Looking at the sun this morning, I saw birds very frequently pass the disc. Some were in focus with the sun itself, the wings being quite sharp against the disc, and must have been several miles high, but some were much nearer, and I estimate

their distance from me at about two miles by the focus required to see them. These last must, however, have been quite a mile above the earth's surface, and of course many were a great deal higher.

"I suppose they were Kites, but the appearance there was rather as though the wings were long and narrow like those of Swallows, whereas I should have expected the points to be blunted by the irradiation.

"The estimated distance between the tips might be a couple of feet.

"Possibly this may interest some of the readers of *Stray Feathers*.

"J. TENNANT, R.E.

"Roorkee, 23rd September, 1875."

On this note the editor of *Stray Feathers*, Mr. A. O. Hume, remarks:—

"Many of those birds must have been quite invisible to the naked eye. I have no doubt that Vultures, Kites, and Eagles often soar for hours at heights at which they are thus invisible to us, though we and our doings are quite within the grasp of their far-seeing gaze. This would help to account for the marvellous manner in which, when an animal is killed in the plains, an apparently speckless sky becomes in an incredibly short space of time crowded with 'an heavenly host.'"

We know so little with respect to the height at which birds do or can fly, that I am sure all ornithologists would gladly avail themselves of any observations on the part of helioscopists or other astronomers that would bear upon the matter, and I may add that perhaps the evidence they could offer might be of importance as regards the migration of birds. In Mr. Hume's remarks I entirely concur.

ALFRED NEWTON

Magdalene College, Cambridge, March 25

How Typhoid Fever is Spread

THE case in which the poison of typhoid fever mixed with drinking water was transmitted through nearly a mile of porous earth, and which was mentioned in the abstract of my discourse to the Fellows of the Chemical Society (NATURE, vol. xiii., p. 331), is fully described (in German) in the 6th Report of the Rivers' Commission on the Domestic Water Supply of Great Britain. It will shortly appear, in English, in the Monthly Journal of the Chemical Society. Meanwhile perhaps I may be allowed to trespass upon your space with the following remarks:—The outbreak of typhoid fever occurred at the village of Lausen, near Basel, in Switzerland, and it was exhaustively investigated by Dr. A. Hägler of Basel, who has given a full account of it in the "Deutsches Archiv. f. Klin. Med. xi." The source of the poison was traced to an isolated farmhouse on the opposite side of a mountain ridge, where an imported case of typhoid, followed by two others, occurred shortly before the outbreak. A brook which ran past this house received the dejections of the patients and their linen was washed in it. This brook was employed for the irrigation of some meadows near the farm-house, and the effluent water filtered through the intervening mountain to a spring used in all the houses of Lausen, except six which were supplied with water from private wells. In these six houses no case of fever occurred, but scarcely one of the others escaped. No less than 130 people, or seventeen per cent. of the whole population, were attacked, besides fourteen children, who received the infection whilst at home for their holidays, and afterwards sickened on their return to school.

The passage of water from the irrigated meadows to the spring at Lausen was proved by dissolving in it, at the meadows, 18 cwt. of common salt, and then observing the rapid increase of chlorine in the spring water; but the most important and interesting experiment consisted in mixing uniformly with the water 50 cwt. of flour, not a trace of which made its way to the spring, thus showing that the water was *filtered* through the intervening earth and did not pass by an underground channel.

These are the main features of the case, but there are other interesting details showing how carefully the investigation was conducted; for these, however, I must refer Mr. Mitchell Wilson to the works above cited. It affords a clear warning of the risk which attends the use, for dietetic purposes, of water to which even so-called *purified* sewage gains access; notwithstanding that, as at Lausen, such water may have been used with impunity for years, until the moment when the sewage became infected with typhoid poison.

E. FRANKLAND